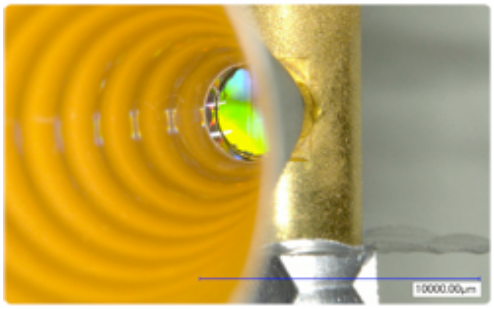
LIVERMORE LAB
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Dec. 12-16, 2011.

R&D

SQUEEZING THE CENTER OF A GIANT



The diamond target sits at the end of a diagnostic cone attached to a gold hohlraum.

National Ignition Facility researchers have replicated conditions believed to exist in the cores of several recently discovered "super-Earths" -- extra-solar planets three to 20 times more massive than Earth.

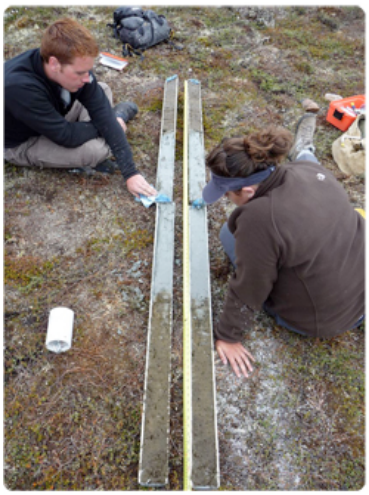
In the first university-based planetary science experiment at NIF, researchers have gradually compressed a diamond sample to a record pressure of 50 Mbar (50 million times Earth's atmospheric pressure).

The experiments could provide clues to the formation and structure of these and other giant planets, as well as the exotic behavior of materials at ultrahigh densities.

The team of scientists used a carefully shaped 20-nanosecond, 750-kiJ NIF laser pulse with 176 beams to ramp-compress multiple thicknesses of diamond. The properties of compressed diamond were then measured at more than six times the pressure previously achieved in similar experiments by the same team at the University of Rochester's OMEGA laser.

To read more, go to *R&D Magazine*.

IN A GEOLOGICAL INSTANT



University of Buffalo students Shanna Losee and Will Phillips inspect a sediment core from Pluto Lake. The thick, gray layer was deposited during an advance of a glacier about 9,200 years ago.

Recent research by the Lab's Dylan Rood and colleagues from the University of Buffalo found that a fast-moving glacier on the Greenland Ice Sheet expanded in a geological instant several millennia ago, growing in response to cooling periods that lasted not much longer than a century.

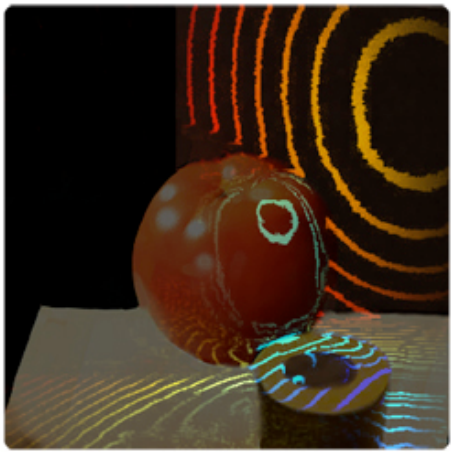
While most may think of an instant as a minute or two, the geologic time scale is just a little bit longer, say about 100 years longer.

The study found that twice in the early Holocene period -- 9,200 years ago and then 8,200 years ago -- Jakobshavn Isbrae, a glacier on Greenland's west coast, overcame rapid shrinkage to expand during brief cooling periods.

The researchers discovered that large rivers of ice that drain ice sheets are extremely sensitive to climate change, from warming and cooling.

To read more, go to *PhysOrg.com*.

CATCHING THE SPEED OF LIGHT



Ripples of waves: A time-lapse visualization of the spherical fronts of advancing light reflected by surfaces in the scene. Image courtesy of MIT.

Laboratory scientists have built imaging systems so fast that they can help characterize the first microseconds of events like laser fusion and nuclear explosions.

As imaging systems become faster and faster, MIT scientists are decreasing that few microseconds and by bringing it down to two trillionths of a second, and, in effect, are able to capture light itself as it passes through liquids and objects.

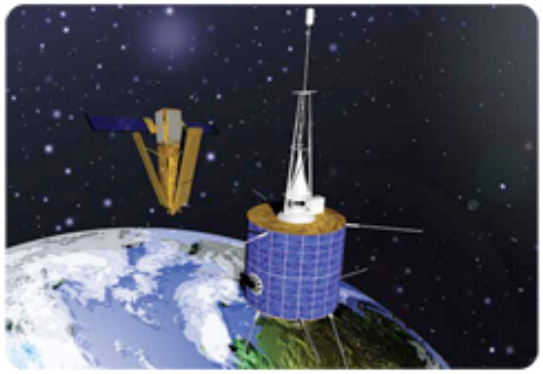
At Livermore, Gary Stone is an optical physicist who builds ultrafast imaging systems.

"To get a two-dimensional image within a picosecond means you have to have a lot of electronics moving really fast," he said.

To read more, go to the *New York Times*.

SCIENCE TODAY at the University of California

WATCH OUT FOR THAT SATELLITE



On Feb. 10, 2009, a defunct Russian satellite, right, and a privately owned American communications satellite, left, collided near the North Pole, producing clouds of debris.

The space environment has become increasingly crowded with satellites. But when these satellites have expended their fuel, run out of batteries or their solar rays are dead, they become space junk.

Since these dead satellites can potentially collide with active ones, government agencies have contacted the national laboratories for help tracking them.

Lab space scientist John Henderson says there are plans to launch a few small satellites in the summer of 2012 that are prototypes of a system his team developed and patented to keep better track of space debris.

To hear the interview, go to *Science Today*.

FOREIGN AFFAIRS
Published by the Council on Foreign Relations

THE CHANGING TIDE

Wind power plants in Xinjiang, China

China has become the main player when talking about energy. The country uses more energy and emits more greenhouse gas than any other on Earth. Its production of power is booming, too.

The Lab's Carbon Management Program Leader, Julio Friedmann, recently opined about the role that China plays in the energy market.

"Every year, China generates nearly 100,000 megawatts more than the previous year -- more than the total generated by California or Texas," he said. The scale of the accompanying infrastructure change is staggering: every week, a new large coal plant opens somewhere in China. This has led to widespread pollution, health problems and environmental degradation -- at the cost to the Chinese economy of about 11 percent of GDP.

"But this is not the same old cautionary tale of dirty development: China has taken these challenges, and the need for energy and 20 million new jobs per year, as a spur to invest in clean technology. Indeed, with the government putting over $50 billion into clean energy R&D every year, China has become a global hub for energy innovation."

To read the full column, go to *Foreign Affairs*.

To send input to the *Livermore Lab Report,* send e-mail.

The *Livermore Lab Report* archive is available on the Web.